PATENT SPECIFICATION

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(19)

(54) PLASTICS CASED PRIMARY CELLS UTILIZING CONDUCTIVE PLASTICS

(71) We, TIMEX CORPORATION, a Corporation organized under the Laws of the State of Delaware, United States of America, of Waterbury, Connecticut 06720, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to plastics cased energy cells or batteries of small size adaptable for specialized shapes suitable for electric or electronic watches or hearing aids. More particularly, this invention relates to a plastics cased cell construction with casings of mouldable resin or plastic and useful for producing small alkaline cells of unconventional shape.

Small primary energy cells used, for example, in watches and hearing aids are well known. These are generally of a circular configuration and known as "button" cells because of their shape. Such cells are generally of the alkaline type and employ metallic cases which, because of the circular shape, can be crimped or swaged around insulating intermediate members to hold the casing halves together.

It is also known to construct energy cells of plastics material and to seal plastics casing members around a peripheral flange, as shown in United States Patent No. 2,966,538. The selective use of conductive plastics in plastics cased cells as a filler material is also known and described in United States Patent No. 3,384,514.

Due to size considerations, and shape of the internal components in devices such as hearing aids and electric watches, it is sometimes desirable to have the energy cell powering the device in some other shape than the conventional circular cross-section. When non-conventional shapes are employed, it becomes difficult to provide proper sealing between metallic casing members by crimping or swaging.

Accordingly, one object of the present invention is to provide an improved construction for a plastics cased energy cell which can be moulded in non-conventional shapes and yet provide an insulating and leak resistant seal between the casing members.

Another object of the invention is to provide an improved plastics cased cell construction of the alkaline type which is suitable for a watch.

According to the invention there is provided an energy cell comprising anode and depolarizing cathode material disposed respectively in opposed plastics casing members, means separating the anode and cathode materials and an electrolyte, each said plastics casing member including at least a portion consisting of an electrically conductive plastics material and a peripheral flange, a metallic spacer disposed in each of said casing members and electrically connecting the conductive plastics material portion thereof with the respective anode or cathode material, said peripheral flanges being juxtaposed and an electrically non-conducting fused connection being formed between said peripheral flanges so as to seal the casing members to one another and insulate the conductive plastics material portions included in each casing member from one another.

The above and other preferred features and advantages of the invention will now be further described in respect of preferred embodiments of the invention, reference being made to the accompanying drawings, in which:—

Figure 1 is a horizontal cross-section of one embodiment of energy cell according to the invention;

Figures 2 and 3 are cross-sections, similar to Figure 1 of respective further embodiments of energy cell, and

Figures 4 and 5 are plan views of cells especially suitable for electric watches and are illustrative, without limitation, of shapes

in which cells according to the present invention may be produced.

Referring to Figure 1 of the drawings, an alkaline energy cell is shown which includes a first plastics casing member 1 and a second opposed plastics casing member 2. The casing members are joined together at respective juxtaposed peripheral flanges 3 and 4.

The internal active materials of the cell, which may be more or less conventional and which are not material to the present invention, are described as follows with reference to Figure 1. Casing 1 contains an anode 5 which may be of granulated zinc, cadmium or indium. The lower casing 2 contains a depolarizing cathode 6 which can be mercuric oxide or monovalent silver oxide mixed with graphite or a mixture of monovalent and divalent silver oxide mixed with silver powder. Separating the anode and cathode materials are a cellulosic absorbent separator 7, a polyethylene methacrylic polymer membrane 8 which can comprise a commercially available polyethylene methacrylic acid grafted polymer called Permion 2291 made by RAI Research Corporation, and a modified polyvinyl alcohol (PVA) membrane 9 made of an air-dried, commercially available solution called "Lemoflex" supplied by Borden Chemical Co. The separators 7, 8 and 9 are substantially in the plane of the flanges 3 and 4.

The casing member 1 is an integral member made of both an electrically conductive plastics terminal portion 10 forming the top surface of the casing and a non-conductive peripheral plastics wall portion 11. Portions 10 and 11 join together along a junction 12. The bottom casing 2 is made in a similar fashion to include an electrically conductive bottom terminal portion 13 fused to a non-conductive peripheral wall portion 14 at a junction 15.

The plastics material itself is a commercially available resin supplied by Allied Chemical International S.A. as resin number H3100. The only difference between conductive portions 10, 13 and non-conductive portions 11, 14 is that the conductive portions are first rendered conductive by filling the uncured resin with carbon black or other electrically conductive compatible materials. Other types of polymer resins may be employed, preferably thermoplastic, which may be moulded to the desired shape.

The means of making an integral casing member such as 1 or 2 with both conductive and non-conductive plastics portions is as follows. An annular member of non-conductive plastics of desired shape is placed in a mould of the proper contour which will form the peripheral wall 11. A pellet of filled, i.e. conductive, resin material is placed in the bottom of the mould, and heat and pressure is applied by a die to fuse the two portions together along junction 12.

Disposed in the anode casing 1 between anode material 5 and the conductive plastics terminal portion 10 is a metallic spacer sheet 16, preferably of copper, which serves both to give added structural support as well as to electrically connect the anode 5 to the conductive plastics terminal portion 10. Similarly, a metal spacer sheet 17, preferably of nickel, serves the same purpose in casing 2, electrically connecting the cathode material 6 with conductive plastics portion 13.

To assemble the cell the components indicated in Figure 1 are added to the two casing halves, a suitable electrolyte such as potassium hydroxide or sodium hydroxide is added, and the peripheral flange portions 3, 4 are then fused together by pressure and heat applied around the periphery.

Reference to Figure 4 shows a plan view of a non-circular cell shape suitable for an electric watch. It is seen that the entire upper surface 10 forms one conductive terminal portion of the battery and that the casing halves are joined around the peripheral flange. A cross-section taken along lines A—A would appear as shown in Figure 1.

Referring to Figure 5 of the drawing, a plan view of another shape of battery suitable for an electric watch is shown as 21. Here it is desired to have a raised conductive terminal portion 22. Reference to Figure 2 of the drawing, which is a cross-section taken along lines B—B of Figure 5, shows how the construction of Figure 1 can be slightly modified to provide a raised conductive plastics terminal portion 22 fused to non-conductive wall 23 and a peripheral flange 24. The mould in which the annular member of non-conductive plastics and the pellet of conductive plastics are fused together is recessed in the conductive region to form the raised conductive portion. The bottom casing half 25 may be constructed exactly as the bottom casing half 2 in Figure 1. Alternately it may be constructed as shown entirely of conductive plastics, so as to include the bottom wall, the peripheral wall, and also a peripheral flange 26.

The peripheral flanges 24 and 26 are sealed as before and, since at least one of them is of non-conductive material, it suitably insulates the conductive half of the casing from the anode material 5 and the conductive plastics terminal portion 22. The other materials inside the casing are the same as described in connection with Figure 1 and have the same reference numbers.

The embodiment of the invention shown in Figure 3 uses a wholly conductive plastics bottom casing half 25 with peripheral flange 26, similar to that described in connection with Figure 2. The opposed or top casing half, indicated by numeral 27 and having a peripheral flange 28, is also wholly made of conductive plastics material. In this case, in order to provide the necessary insulating seal between the juxtaposed conductive peripheral flanges 26 and 28 a non-conductive plastics ring 29 with central aperture 30 is used as an intermediate member between the flanges 26 and 28. The heat or pressure seal is easily accomplished as before around the peripheral flange. The Figure 3 construction may also be used to produce cells of irregular or non-conventional shape, and the casing members can be moulded in shapes exemplified in Figures 4 and 5.

Thus there has been shown an improved plastics cased energy cell which, by means of an insulating peripheral flange connection and the selective use of conductive and non-conductive plastics materials in the cell and casing construction, makes it possible to construct cells of any desired shape.

WHAT WE CLAIM IS:—

1. An energy cell comprising anode and depolarizing cathode material disposed respectively in opposed plastics casing members, means separating the anode and cathode materials and an electrolyte, each said plastics casing member including at least a portion consisting of an electrically conductive plastics material and a peripheral flange, a metallic spacer disposed in each of said casing members and electrically connecting the conductive plastics material portion thereof with the respective anode or cathode material, said peripheral flanges being juxtaposed and an electrically non-conducting fused connection being formed between said peripheral flanges so as to seal the casing members to one another and insulate the conductive plastics material portions included in each casing member from one another.

2. An energy cell according to Claim 1, where at least one of said casing members is an integral plastics member comprising a portion of said electrically conductive plastic material fused to a remaining portion consisting of a non-conductive plastics, said latter portion including said peripheral flange.

3. An energy cell according to Claim 1, wherein each of said casing members is an integral plastics member wholly of said electrically conductive plastics material and wherein a non-conductive plastics spacer member is disposed between and fused to said peripheral juxtaposed flanges.

4. An energy cell according to Claim 2 or Claim 3, wherein said conductive and said non-conductive plastics is a mouldable thermoplastic resin, the conductive plastics being of the same chemical composition as the non-conductive but having dispersed therein particles of electrically conductive material.

5. An energy cell according to Claim 4, wherein said electrically conductive material is carbon black.

6. An energy cell according to any one of Claims 1 to 5, wherein said casing members are of non-circular configuration.

7. An energy cell according to any one of Claims 1 to 6 including means separating said anode and said cathode materials, said means being located substantially in the plane of said peripheral flanges.

8. An energy cell according to claim 1 and substantially as hereinbefore described with reference to any one of the Figures of the accompanying drawings.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

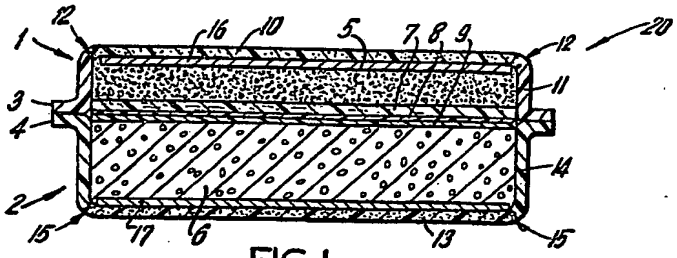

FIG.1

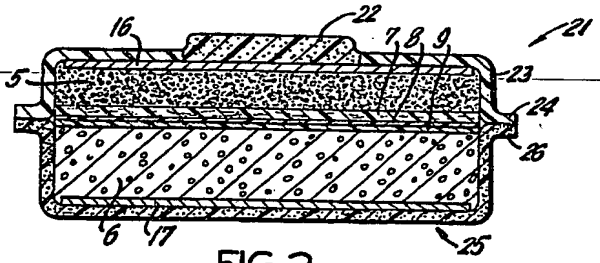

FIG.2

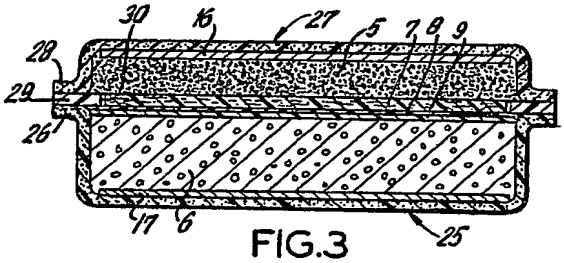

FIG.3

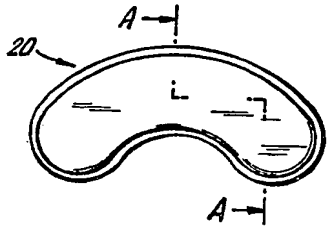

FIG.4

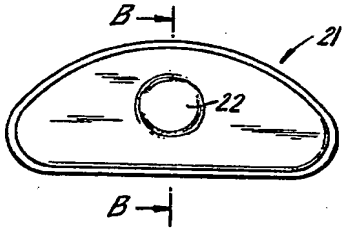

FIG.5